**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC 20554**

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| In the Matter of | ) | |
| | ) | |
| Amendment of Parts 2 and 25 of the Commission's | ) | IB Docket No. 07-101 |
| Rules to Allocate Spectrum and Adopt Service Rules | ) | |
| and Procedures to Govern the Use of Vehicle-Mounted | ) | |
| Earth Stations in Certain Frequency Bands Allocated to | ) | |
| the Fixed-Satellite Service | ) | |

# PETITION FOR RECONSIDERATION


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## SUMMARY

ViaSat applauds the Commission's efforts to establish vehicle-mounted earth station ("VMES") service rules to facilitate the introduction of innovative, mobile broadband services to commercial, consumer, and governmental users in the United States. Given the ubiquitous coverage of satellites, and the relatively low capital costs of extending service to new users, fixed-satellite service ("FSS") systems provide a cost-effective means of making high-quality mobile broadband services available to all Americans through VMES technologies. These technologies enable the provision of high-speed broadband service to vehicles through antennas as small as 30 cm (under 12 inches), and can be used to support homeland security, border patrol, and local police and fire/rescue operations, and for commercial and consumer applications on automobiles, buses, recreational vehicles, and other modes of transportation.

Insofar as it establishes the VMES service, provides for more flexible use of FSS spectrum, and represents an initial effort to craft rules governing the VMES service, the *VMES Order* undoubtedly is a step in the right direction. That being said, the regulatory framework adopted in the *VMES Order* appears to assume that one type of VMES technology—characterized by relatively large, expensive terminals with a narrowly targeted user base—will be most prevalent. That assumption is unwarranted given the nascent nature of the VMES industry, and is inconsistent with the efforts of ViaSat and others to develop small, low-cost terminals that will appeal to the masses and drive the widespread adoption of VMES technologies as one possible mobile broadband solution.

The *VMES Order* does not accommodate the full potential of VMES and in fact imposes considerable constraints that, if left unmodified: (i) would unduly limit the potential of the VMES service and prevent service providers from fully leveraging the capabilities of satellite

technologies in providing mobile broadband service to the public; (ii) would conflict with the mandate set forth by Congress in the American Reinvestment and Recovery Act, which clearly directs the Commission to *remove*, rather than *erect*, barriers to the provision of innovative broadband services to the public; and (iii) would undercut the Commission's own efforts to extend the availability of mobile broadband services through the development and implementation of the National Broadband Plan.

In particular, even though there is no evidence that additional constraints are needed to prevent harmful interference or otherwise protect the public, the VMES service rules:

(i) require VMES systems using variable power-density control (a technique designed to increase the efficiency of VMES systems) to operate at power-density levels roughly 20 percent lower than those that otherwise would be applicable, and that are in fact applicable to other types of earth station systems;

(ii) preclude VMES systems that use variable power-density control, or that operate in excess of "default" antenna pointing limits while still complying with the Commission's power-density limits, from acquiring the otherwise-available "ALSAT" licensing designation, which may delay both system implementation and the ability of operators to respond to changing market conditions; and

(iii) require VMES operators to cease transmissions if the downlink signal from the satellite to the terminal is blocked for even 1/10$^{th}$ of a second—even though such interruptions can be exceedingly common in the typical mobile operating environment and would not otherwise cause a gap in service.

In order to align the VMES service rules with national broadband policy, while ensuring that the Commission can evaluate fully any proposed VMES system (and address any perceived issues during licensing through appropriate conditions), ViaSat respectfully requests that the Commission revise the new rules to:

(i) permit VMES operators that use variable power-density control to demonstrate in their applications that they are capable of complying with the Commission's power-density limits;

(ii) permit VMES operators that use variable power-density control, or that operate in excess of "default" antenna pointing limits while still complying with the Commission's power-density limits, to obtain "ALSAT" authority and

communicate with all U.S.-licensed and non-U.S.-licensed "Permitted Space Station List" satellites without the need to seek additional license modifications; and

(iii) allow VMES operators, like other FSS earth station operators, to demonstrate in their applications that they will comply with Commission rules designed to mitigate RF exposure, instead of constraining these operators with an unnecessary, inflexible "shut-down" requirement based on loss of a downlink signal.

To implement these changes, ViaSat respectfully requests that the Commission make the revisions to its new rules proposed in Exhibit A hereto. In addition, and in order to ensure that the VMES rules provide the flexibility embodied in the underlying sections of the *VMES Order*, the Commission should clarify: (i) certain rules regarding the way in which one should calculate compliance with the Commission's power-density limits; as well as (ii) the meaning of the antenna pointing accuracy requirements for VMES terminals.

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**PETITION FOR RECONSIDERATION**

Pursuant to Section 1.429 of the Commission's rules,[1] ViaSat, Inc. ("ViaSat") respectfully requests that the Commission reconsider certain aspects of the *Report and Order* released on July 31, 2009 in this proceeding ("*VMES Order*"). In the *VMES Order*, the Commission adopted service rules for the nascent vehicle-mounted earth station ("VMES") industry that are intended to "promote the innovative and flexible use of satellite technology," and to "increase the potential that broadband communications capabilities will be made available for various emergency preparedness and commercial purposes where high-bandwidth, advanced mobile communications capabilities are beneficial."[2]

VMES technologies enable the provision of high-speed broadband service to vehicles through antennas as small as 30 cm (under 12 inches), and can be used to support homeland security, border patrol, and local police and fire/rescue operations, and for commercial and consumer applications on automobiles, buses, recreational vehicles, and other modes of transportation. At bottom, these technologies represent an extension into a mobile operating environment of proven VSAT technologies that traditionally have been confined to fixed settings. As the Commission is well aware, VSAT terminals have been a critical means of

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[1] 47 C.F.R. § 1.429.

delivering broadband services to otherwise unserved or underserved *fixed* locations where terrestrial alternatives, such as cable or DSL, are unavailable. VMES terminals on land, as well as aeronautical-mobile satellite service ("AMSS") terminals in the air and earth station on vessel ("ESV") terminals at sea, allow users to enjoy the benefits of satellite broadband without shackling them to fixed locations. Thus, these terminals are critical to facilitate the ubiquitous availability of high-data-rate mobile broadband service to vehicles throughout the United States.

Insofar as it establishes the VMES service, provides for more flexible use of FSS spectrum, and represents an initial effort to craft rules governing the VMES service, the *VMES Order* undoubtedly is a step in the right direction. That being said, the regulatory framework adopted in the *VMES Order* appears to assume that one type of VMES technology—characterized by relatively large, expensive terminals with a narrowly targeted user base—will be most prevalent. That assumption is unwarranted given the nascent nature of the VMES industry, and is inconsistent with the efforts of ViaSat and others to develop small, low-cost terminals that will appeal to the masses and drive the widespread adoption of VMES technologies as one possible mobile broadband solution.

As a result, certain of the rules adopted in the *VMES Order* do not advance the Commission's stated policy objectives, including the broad objectives underlying the developing National Broadband Plan. Rather, these rules impose unnecessary *ex ante* restrictions on VMES operations that likely will preclude the developing VMES industry from implementing the most innovative, efficient, and affordable mobile broadband solutions for commercial, consumer, and government applications. By adjusting the VMES rules in a manner that is consistent with the longstanding framework that governs the VSAT industry, the Commission can provide VMES

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[2] *VMES Order* at ¶ 2.

system developers with the flexibility they need to deliver the most cost-effective and spectrally-efficient services possible. Significantly, this can be achieved *without* adversely affecting the interference environment. Accordingly, ViaSat respectfully requests that the Commission relax or remove certain restrictions in its reconsideration of the *VMES Order*, as proposed in Exhibit A hereto.

## I. THE COMMISSION SHOULD REVISE OR CLARIFY ITS RULES TO ALLOW VMES APPLICANTS TO FACILITATE THE DESIGN AND IMPLEMENTATION OF SYSTEMS INCORPORATING VARIABLE POWER-DENSITY CONTROL

The stated policy goal of the *VMES Order* is to promulgate rules that "promote innovative and flexible use of satellite technology."[3] This goal, of course, is fully consistent with the Commission's efforts to extend the availability of broadband services and technologies—and particularly mobile broadband services and technologies—to all Americans. It also is fully consistent with the mandate set forth by Congress in the American Reinvestment and Recovery Act ("Recovery Act").[4] Unfortunately, the *VMES Order* falls short of actually achieving this goal because it unduly constrains the ability of VMES applicants to even *propose* to employ spectrally-efficient variable power-density systems, which would significantly enhance the provision of affordable mobile broadband services to the public, and actually reduce the likelihood of harmful interference (as compared to systems that operate terminals at the same, fixed power-density levels).

As an initial matter, there are actually two broad sub-classes of "variable" power-density VMES systems. The first type features terminals that operate at any number of different power-density levels, but in a manner that remains *static*. Systems that incorporate this "static"

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[3] *Id.*

[4] *See* 47 U.S.C. § 1305(k).

variable power-density control are similar, in most respects, to fixed power-density systems; aggregate power-density is known from the outset and does not change often.

These "static" variable power-density control systems differ from systems that incorporate "dynamic" variable power-density control. Such "dynamic" systems feature terminals that operate at any number of different power-density levels *and* vary those levels over time. The concept behind such systems is quite simple: Instead of transmitting at full power on a continuous basis, they *dynamically* allocate limited power and bandwidth to those network terminals that need them most at any given time. In a sense, these dynamic variable power-density systems are akin to the sophisticated technologies being developed in other industries, such as energy conserving devices that consume power only when really needed.

There are several advantages to using dynamic variable power-density control. Because the performance of a satellite typically is not uniform over its footprint, some terminals do not need to operate at the same high power level as others to achieve an equivalent level of performance. By allowing terminals to transmit only the power that they need to provide service, dynamic variable power-density systems reduce aggregate power density and the consequent interference risk, while allowing the network to operate more efficiently. In contrast, fixed power-density systems force VMES operators to maintain an equal allocation of power across terminals, requiring those terminals to operate at the relatively high power levels necessary for the most disadvantaged terminal to close the link, thus wasting limited satellite and spectrum resources and creating a greater risk of interference.

The availability of dynamic variable power-density control also allows the operator to provide service to different terminal types and at varying data rates over the same network on a dynamic basis. By varying the power density allocated to individual terminals, the

operator can achieve this goal within a fixed amount of bandwidth. For example, by halving a terminal's effective data rate, the operator can halve its transmitting power density and make that power available to serve another end user. In contrast, fixed power-density systems normally compel a provider to offer service at a single data rate, forcing some customers to purchase throughput that they do not need and may never use, and for which they may not wish to pay.

While the *VMES Order* does contemplate the use of both types of variable power-density control, the order handicaps their use by imposing unnecessary constraints that do not apply to other transmission technologies. In particular, the *VMES Order* requires VMES applicants using variable power-density control to operate at roughly 20 percent (1 dB) below the power-density limits that otherwise would apply, and that in fact apply to other FSS earth stations. Further, the *VMES Order* requires VMES operators using variable power-density control to apply separately for authority with respect to each and every satellite with which they wish to communicate, in contrast to other VMES licensees that can communicate with any U.S.-licensed or non-U.S.-licensed "Permitted Space Station List" satellite. These restrictions significantly limit the ability of variable power-density networks to operate and create disincentives for operators to incorporate variable power-density control into their networks. In order to remove these disincentives, and maximize the ability of VMES operators to provide efficient, flexible, and affordable mobile broadband services to the public, the Commission should revise its VMES rules to remove these restrictions, provided that applicants explain how their VMES networks would comply with Commission requirements.

### A. VMES Systems Using Variable Power-Density Control Should Be Able to Operate at the Same Power-Density Levels Applicable to Other Transmission Technologies

The *VMES Order* promulgates new Section 25.226(a)(3)(i) of the Commission's rules, which allows the use of variable power-density control as long as the effective aggregate power density of the network is backed off to a level that is roughly 20 percent (1 dB) below the power-density levels at which other types of VMES terminals (as well as ESV and VSAT terminals, for that matter) routinely are allowed to operate. New Section 25.226(b)(3)(i) requires each VMES applicant to "make a detailed showing of the measures it intends to employ" to comply with these power-density limits.[5]

The *VMES Order* suggests that a reduction in power density with respect to "aggregate dynamic-power system[s]" is necessary because such systems are more "complex" than fixed power-density systems, and specific rules for such systems do not exist in the VSAT or ESV contexts.[6] Notably, the *VMES Order* raises concerns only with respect to "dynamic" variable power-density systems, and raises no concerns whatsoever with respect to "static" variable power-density systems. Contrary to the apparent intent of the *VMES Order*, though, Sections 25.226(a)(3)(i) and 25.226(b)(3)(i) compel *all* variable power-density systems to reduce power. If nothing else, then, the Commission should revise these Sections to make clear that static variable power-density systems are not subject to the 1 dB reduction.

In any event, there is no basis for requiring *either* static or dynamic variable power-density systems to reduce power. As noted above, the Recovery Act makes clear Congress's intent to expand the availability of broadband services by encouraging innovative technological solutions, such as variable power-density control. While the *VMES Order*

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[5] 47 C.F.R. §§ 25.226(a)(3)(i), 25.226(b)(3)(i).

recognizes that the required reduction in power density will "impact the capacity and robustness of the relevant VMES networks" by limiting their flexibility,[7] the Commission does not quantify this impact or consider the dramatic effect that a 1 dB reduction in power density would have on network operations and efficiency.

In light of clear policy guidance from Congress, which has been embraced by the Commission in its development of the National Broadband Plan, the Commission should not restrict the ability of operators to develop and implement innovative approaches to network design, such as variable power-density control, unless it can establish a clear need to impose such a restriction.[8] Significantly, there is no record evidence to suggest that the use of variable power-density control poses a risk of harmful interference, or that operators of terminals with that capability are not able to comply with the same power-density levels applicable to other earth stations.

The assertion that dynamic variable power-density systems are "complex" does not justify differential treatment of such systems—and certainly does not justify differential treatment of static variable power-density systems. Before a VMES applicant proposing to employ variable power-density control can be licensed, it must satisfy the Section 25.226(b)(3)(i) requirement to "make a detailed showing of the measures it intends to employ" to satisfy the applicable power-density limit. Once the applicant satisfies the Commission that it can control its aggregate power-density to any given level, there is no rational basis for constraining the applicant's operations to a level that is roughly 20 percent lower than that which otherwise

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[6] *VMES Order* at ¶¶ 115-116.

[7] *Id.* at ¶ 118.

would be applicable. Rather than impose an inflexible, *ex ante* power reduction requirement, the Commission should afford an operator an opportunity to demonstrate that it can comply with the same power-density levels that apply to other earth stations.

Moreover, the *VMES Order* fails to establish any logical connection between the "complexity" of a system using dynamic variable power-density control and any increased interference risk that conceivably could justify requiring a reduction in power density. As ViaSat noted in its comments in this proceeding, code division multiple access ("CDMA") networks with a sophisticated network management system ("NMS") are capable of ensuring that the applicable aggregate power-density limit is met for the entire network.[9] Notably, dynamic variations in a terminal's power-density levels are controlled by the NMS, and a terminal is permitted to increase or decrease power only *after* the NMS: (i) performs the calculations necessary to confirm that such an increase or decrease would not result in aggregate power-density levels exceeding applicable limits; and (ii) informs the terminal of this fact. As such, the NMS does not "have to rely on complicated techniques" to overcome the time-lag of the control signal to the VMES terminal—contrary to the Commission's suggestion.[10] Rather, the NMS ensures that network operations remain within applicable power-density limits just as effectively as the network management systems that govern time division multiple access ("TDMA") and frequency division multiple access ("FDMA") networks. In this respect, it bears

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[8] *See, e.g., Chevron U.S.A., Inc. v. NRDC*, 467 U.S. 837 (1984) ("If the intent of Congress is clear, that is the end of the matter; for the . . . agency . . . must give effect to the unambiguously expressed intent of Congress.").

[9] *See* Comments of ViaSat, Inc. at 17 (Aug. 17, 2007).

[10] *See VMES Order* at ¶ 111.

emphasis that TDMA and FDMA systems in other services that employ power control features are not required to operate at 20 percent below the otherwise applicable power-density limits.[11]

Moreover, even if the NMS did not have the "lead" in controlling VMES power changes, a large increase in the power density of one or several VMES terminals would not have a significant impact on the aggregate power-density level of the system. In this respect, CDMA systems, in general, have less of an interference potential than TDMA and FDMA systems, which the Commission has allowed to operate without any decrease in applicable power-density limits. Notably, if the carrier power associated with a TDMA or FDMA terminal is increased by 3 dB, the net increase in aggregate power density for the system also is 3 dB. In other words, there is a one-to-one relationship between increased power of a single TDMA or FDMA terminal and increased aggregate power density of the network. In contrast, in the case of a CDMA system with 15 terminals, if a single terminal increases power by 3 dB, the net increase in aggregate power density is only 0.28 dB; *every* terminal needs to increase power by 3 dB in order to increase the aggregate power density of the network by 3 dB. Moreover, because dynamic variable power-density systems increase power on an infrequent basis,[12] it is unlikely that a significant number of terminals would increase power at the same time, although the resulting increase in aggregate power density would be small and manageable in any case.

Further, the risk of interference actually is mitigated by the availability of dynamic variable power-density control, which allows the system to flexibly allocate system

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[11] *See, e.g.*, 47 C.F.R. § 25.204. In that case, the Commission assumes that the extra power is absorbed by rain.

[12] "Dynamic" power-density systems are largely static over time. For example, ViaSat's system allows individual terminals to increase power principally to compensate for: (i) rain fade; (ii) movement across the satellite footprint; and (iii) partial signal obstruction. At any

resources so as to increase efficiency while actually *decreasing* the potential for harmful interference. Unlike fixed power-density systems, dynamic variable power-density systems mitigate the risk of harmful interference by ensuring that terminals operate at the minimal power-density levels necessary to close the satellite link. Consequently, these systems actually pose *less* of a risk of harmful interference into adjacent systems than fixed power-density systems.

Since dynamic variable power-density systems can be managed effectively by operators so as to ensure compliance with the Commission's rules and avoid causing harmful interference, requiring a 20 percent reduction in power is unjustifiable—particularly in light of the sharp reduction in network efficiency and flexibility that flows directly from this reduction, and the resulting direct, quantifiable, and adverse impact on the ability of VMES licensees to provide mobile broadband services to the public. Certainly, there is no basis for requiring such a reduction in the case of static variable power-density systems, for which sophisticated network management tools are not necessary at all.

Accordingly, the Commission should revise its rules to permit VMES applicants proposing to use variable power-density control to demonstrate that they can comply with the same power-density limits that apply to other earth stations. Notably, this change would not preclude the Commission from requiring such applicants to operate at reduced power as a licensing condition, if the Commission were to conclude affirmatively that such a reduction was necessary *after* reviewing an applicant's technical showing.

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given time, the NMS would be expected to cause only a few terminals to increase their transmitting power density (or cease transmissions) due to these factors.

### B. VMES Systems Using Variable Power-Density Control Should Be Subject to the Same Power-Density Limits as VMES Applicants Using TDMA or FDMA Protocols

New Section 25.226(a)(1) of the Commission's rules specifies power-density limits for VMES terminals using a series of formulas that incorporate a variable "N."[13] The rule provides that: (i) in the case of a VMES network using a TDMA or a FDMA protocol, "N" is equal to one; and (ii) in the case of a VMES network using multiple co-frequency transmitters that operate at the *same* power-density levels (*i.e.*, a fixed power-density system using a CDMA protocol), "N" is the "maximum expected number of co-frequency simultaneously transmitting VMES earth stations in the same satellite receiving beam."[14] However, the rule does not define "N" in the case of a VMES network using multiple co-frequency transmitters that operate at *different* power-density levels (*i.e.*, a static or dynamic variable power-density system using a CDMA protocol). Rather, Section 25.226(a)(3) governs such systems.[15]

As noted above, Section 25.226(a)(3)(i) specifies that VMES networks using variable power-density control must operate at lower power-density levels than those specified for other systems in Section 25.226(a)(1).[16] More specifically, the rule requires that such networks maintain "effective aggregate [power]-density from all terminals" at levels lower than those applicable under Section 25.226(a)(1),[17] with "effective" defined to mean that aggregate power density may not exceed the power density produced by a *single* VMES transmitter operating in accordance with applicable power-density limits set forth in Section 25.226(a)(1) of

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[13] *See* 47 C.F.R. § 25.226(a)(1).

[14] 47 C.F.R. § 25.226(a)(1)(i)(A).

[15] *See* 47 C.F.R. § 25.226(a)(3).

[16] *See* 47 C.F.R. § 25.226(a)(3)(i).

[17] *Id.*

the Commission's rules.[18] The rule thus implies that, in the case of a VMES network using variable power-density control, "N" is equal to one—as is the case with respect to TDMA and FDMA systems. However, the rule stops short of stating as much explicitly. As such, it is unclear what power-density limits are applicable to a VMES operator using variable power-density control.

The Commission can and should eliminate this ambiguity by revising Section 25.226(a)(3) to make clear that, in the case of *variable* power-density systems using CDMA protocols, "N" is equal to one. Doing so would not only ensure consistency between Sections 25.226(a)(1) and 25.226(a)(3), but also would recognize that, in the case of a variable power-density system using a CDMA protocol: (i) the number of operating terminals is likely to vary in response to changes in the operating environment and market demand; (ii) operators can use a variety of methods to ensure that the operation of multiple terminals does not result in harmful interference; and (iii) the risk of harmful interference, even accounting for any variation in the number of operating terminals, is actually *lower* than the risk of harmful interference from a TDMA or FDMA system.[19] Notably, the Commission already permits VMES applicants to use

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[18] *Id*. *See also* 47 C.F.R. § 25.226(a)(1).

[19] In the TDMA or FDMA context, "collisions" between the transmissions from different terminals are not uncommon. At maximum throughput, approximately 54 percent of the transmissions over a Slotted Aloha channel will result in a collision, such that it could be necessary to retransmit a single packet several times before it was received successfully by the intended recipient. Each such collision increases the overall transmit power density of the system; a collision of two packets roughly doubles aggregate power density (an increase of 3 dB), a collision of three packets roughly triples aggregate power density (an increase of 4.7 dB), and so on. In contrast, in a CDMA system packets that are transmitted at the same time merely result in a small and manageable increase in system noise. Notably, this is the case with respect to *all* CDMA systems, including those operating with fixed power-density.

contention access protocols so long as they are "reasonable," without requiring applicants to declare their intended load factor or the likelihood that collisions would occur.[20]

### C. VMES Systems Using Variable Power-Density Control Should Be Eligible for ALSAT Authority

Under longstanding Commission precedent, Ku-band earth station licensees that meet the Commission's "default" power density levels may be authorized on an "ALSAT" basis, which allows them to communicate with any U.S.-licensed satellite, as well as with any non-U.S.-licensed satellite that is on the "Permitted Space Station List." ALSAT status provides considerable benefits, including speeding the provision of service to the public, because it obviates the delay and cost associated with modifying an earth station license whenever a VMES provider acquires transponder capacity on a new or different spacecraft.

The *VMES Order* extends the ability to receive ALSAT authority to VMES systems that meet the default power-density and antenna pointing limits for VMES.[21] However, the *VMES Order* declines to extend that benefit to VMES licensees that use variable power-density control, without offering any explanation for this decision.[22] This denial of ALSAT authority necessarily will force VMES applicants that use variable power-density control to apply separately for authority to communicate with each and every spacecraft on which they lease transponder capacity, and to reapply whenever they shift that capacity to a new or different spacecraft. Such a requirement places an undue burden on the VMES operator, and delays its ability to flexibly allocate satellite resources to VMES operations, decreasing network efficiency,

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[20] *See* 47 C.F.R. § 25.226(a)(4).

[21] *VMES Order* at ¶ 168.

[22] *Id.*

increasing costs, and ultimately decreasing the affordability of mobile broadband solutions for consumers.

The lack of explanation for this decision makes it impossible to address the Commission's reasoning.[23] In other contexts, ALSAT authority applies in cases where an applicant complies with the Commission's technical rules—including the power-density limits—necessary to ensure two-degree spacing compatibility. Thus, a fixed power-density VMES system that complies with those limits is eligible for ALSAT licensing. Where a variable power-density VMES system can demonstrate an equivalent level of compliance, the same reasoning should apply; there is no reason to deny ALSAT authority to a VMES applicant that complies with applicable power-density limits and other technical rules, and does not otherwise need to coordinate system operations as a prerequisite to licensing.[24] Certainly, there could be no reason to question how a *static* variable power-density system would comply with such limits. Similarly, there is no reason to deny ALSAT authority to a VMES applicant that exceeds the Commission's "default" antenna pointing limits, as permitted by Sections 25.226(a)(1)(ii) and (iii) of the Commission's rules,[25] but complies with applicable power-density limits.

## II. THE COMMISSION SHOULD AFFORD VMES APPLICANTS FLEXIBILITY IN COMPLYING WITH RF EXPOSURE LIMITS

The *VMES Order* promulgates new Section 25.226(a)(9) of the Commission's rules, which requires VMES terminals to cease operations within 100 milliseconds of losing a

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[23] *See, e.g., Ctr. for Auto Safety v. FHA*, 956 F.2d 309, 313 (D.C. Cir. 1992); *Am. Trading Transp. Co. v. United States*, 791 F.2d 942, 949 n.10 (D.C. Cir. 1986) (noting that conclusions drawn from "assumption[s] based on no evidence would rank as arbitrary and capricious under the Administrative Procedure Act").

[24] While ALSAT licensing would not make sense in a case where coordination with adjacent systems is a prerequisite to licensing, coordination is not a requirement where a VMES system using variable power-density control meets applicable limits.

downlink signal from the target satellite.[26] The *VMES Order* indicates that this requirement is "a mitigation technique for RF exposure."[27] However, the Commission provides no basis for departing from the more general standard used for VSATs and ESVs,[28] which does not impose any fixed shut-down requirement, or for selecting this specific 100 millisecond requirement only for VMES terminals.

The imposition of a 100 millisecond shut-down requirement is unduly restrictive and does not take into account the operational environment for VMES terminals. In fact, momentary downlink signal interruptions are inherent in the nature of mobile operations, and need not interrupt service. Further, in the vast majority of cases, these interruptions will be the result of terrain or man-made artifacts—as opposed to the presence of a human being between the antenna and the satellite. Notably, many VMES terminals incorporate features that limit the potential for human RF exposure. For example, radomes prevent an individual from inserting a body part between the reflector and feed horn, thus providing mitigation by limiting exposure to near-field levels or lower levels.

For example, a VMES terminal mounted on a vehicle driving at 35 miles per hour (or 5.1 feet per 100 milliseconds) and passing under an overhanging tree occupying an effective

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[25] 47 C.F.R. §§ 25.226(a)(1)(ii) and (iii).

[26] 47 C.F.R. § 25.226(a)(9).

[27] *See VMES Order* at ¶ 189. In addition, Section 25.226(a)(1)(iii) of the Commission's rules requires the terminal to shut-down within 100 milliseconds if it is mispointed. 47 C.F.R. § 25.226(a)(1)(iii). This other rule provides sufficient protection to ensure that the terminal does not cause harmful interference into adjacent operations.

[28] Notably, and contrary to the Commission's suggestion in the *VMES Order*, ViaSat supported this more general standard, and raised specific concerns about the imposition of a more restrictive, time-based requirement. *See* Reply Comments of ViaSat, Inc., at 28 (Sep. 4, 2007) ("As with VSATs, the Commission should not impose a time limit to cease transmissions upon the loss of a forward-link lock on the satellite as there are many potential factors, such as rain fade, to consider in setting the shutdown time.").

linear distance of 5.5 feet would experience a complete loss of receive signal for more than 100 milliseconds. Through the application of blockage mitigation techniques, this terminal would be able to continue transmitting during this period. Yet, the requirements of Section 25.226(a)(9) would force this terminal to cease operating—even though the blockage would cease to exist in short order. The VMES terminal then would need to reacquire the receive signal and reenable transmit, which would take some time. The result would be an interruption in communications service and a significant loss of system performance, which would be entirely unnecessary because the blockage would have been removed, and would not have been caused by a human being in the first place.

In any event, the presence of a human being in the VMES terminal's transmit or receive path—which should happen rarely in any event—would be highly unlikely to present a radiation hazard to that individual. This point is illustrated in Exhibit B, which evaluates several VMES systems based on the transmitting levels claimed in the radiation hazard analyses provided with the underlying system applications (see Table B.1). More specifically, Exhibit B presents the effective radiation hazard exposure levels associated with each VMES terminal type for shut-down times of 1, 2, 3, 4, and 5 seconds (see Table B.2). Exhibit B also specifies the number of times an individual could be exposed to each VMES terminal type/shut-down time combination without exceeding the Commission's RF exposure limits (see Table B.3).[29] In short, Exhibit B shows that an individual could be exposed to radiation from a VMES terminal of several seconds in duration, on many occasions, and still be well under the applicable RF exposure limit.

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[29] Generally, the projected radiofrequency cylinder from a VMES antenna will be well above the heads of any individual in the vicinity of a vehicle outfitted with a VMES terminal due to

Thus, it should be clear that the 100 millisecond shut-down limit specified in Section 25.226(a)(9) is unduly restrictive, particularly considering the mobile environment in which VMES terminals, by definition, will operate. Instead of imposing an across-the-board limitation, the Commission can and should permit VMES applicants the same flexibility in designing their systems that the Commission affords to VSAT and ESV applicants. In other words, applicants should be required to ensure that their systems do not exceed the Commission's RF exposure limits, and to demonstrate as much in their applications, but should not be subject to a more restrictive 100 millisecond automatic "shut-down" requirement.[30]

## III. THE COMMISSION SHOULD CLARIFY ITS RULES WITH RESPECT TO ANTENNA POINTING

The *VMES Order* appears to establish a flexible regulatory framework governing the accuracy with which VMES antennas must point at their "target" satellites. Among other things, the order permits VMES operators to: (i) operate systems that do not maintain a 0.2 degree pointing tolerance, provided their operations remain consistent with the Commission's off-axis EIRP spectral-density ("OAED") mask; and (ii) operate VMES systems that exceed that OAED mask (while maintaining the 0.2 degree pointing tolerance), provided the operations have been coordinated with adjacent satellite operators.[31]

ViaSat applauds these efforts. In order to provide the certainty that is needed to facilitate the continued development of VMES services and technologies, however, certain clarifications or revisions of the new VMES rules are warranted. In particular, the new rules should be revised to specify clearly that: (i) the default 0.2 degree pointing tolerance is a *peak*

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the elevation angle to the satellite. Since any human RF exposure is likely to be in the near field of the antenna, Exhibit B uses higher near field levels as the basis for its calculations.

[30] *See* 47 C.F.R. § 25.134(h).

[31] *See VMES Order* at ¶¶ 126-135.

(rather than a maximum) level; (ii) applicants must specify both *peak* pointing tolerance and *maximum* mispointing levels; (iii) the pointing tolerances specified in the rules encompass both deliberate and non-deliberate antenna misorientation away from the target satellite; and (iv) VMES operators may specify pointing tolerances that vary from the default values *and* exceed the OAED mask—provided that the combined effect has been coordinated with adjacent satellite operators.

### A. It Should Be Made Clear that the Default 0.2 Degree Pointing Tolerance Level Is a *Peak* Level

The default 0.2 degree pointing tolerance level set forth in new Section 25.226(a)(1)(ii)(A) of the Commission's rules carries forward a similar technical requirement found in former Section 25.222(a)(6) of the Commission's rules in the ESV context.[32] In promulgating that level of pointing tolerance (*i.e.*, "pointing error"), the Commission made clear its intent to be "consistent with the technical parameters contained in [ITU] Resolution 902," which requires operators to maintain a pointing accuracy within 0.2 degrees *peak*.[33] A "peak" value in this context is commonly understood to be the value three standard deviations above the mean value in a normal distribution (*i.e.*, to represent a degree of mispointing greater than or equal to approximately 99.7 percent of all values in that distribution). Thus, the Commission did not intend the 0.2 degree level to be a maximum, but rather understood that this level would be exceeded only on rare occasions.

Similarly, the default 0.5 degree "shut-down" limit set forth in new Section 25.226(a)(1)(iii)(A) of the Commission's rules carries forward a similar technical requirement

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[32] *See* 47 C.F.R. §§ 25.222(a)(6) (2005).

[33] *See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/ 11.7-12.2 GHz Bands*, Report and Order, 20 FCC Rcd 674, at ¶ 104 n.271 (2005).

found in former Section 25.222(a)(7) of the Commission's rules.[34] Whereas the lower 0.2 degree pointing tolerance level is properly understood as a *peak* level, the higher 0.5 degree "shut-down" limit can be understood as a *maximum* limit on antenna misorientation away from the target satellite.

There is no indication in the *VMES Order* that the Commission intended to change this understanding of the relationship between the pointing tolerance and "shut-down" levels. Yet, the language of new Section 25.226(a)(1)(ii)(B) creates significant ambiguity about the relationship between these levels. Notably, the language in the new rule permits VMES applicants to "declare a *maximum* antenna pointing error . . . greater than 0.2°" provided applicable OAED limits are met.[35] Unfortunately, this language implies that the default 0.2 degree pointing tolerance level specified in Section 25.226(a)(1)(ii)(A) is a *maximum*, as opposed to a *peak*, level. Such an interpretation would be inconsistent with Resolution 902 and the Commission's previously stated intention in establishing the original ESV service rules, and also would undermine the apparent basis for maintaining the pointing tolerance and mispointing "shut-down" levels at different values.

Accordingly, ViaSat respectfully requests that the Commission: (i) revise Section 25.226(a)(1)(ii)(A) to explicitly state that the 0.2 degree pointing tolerance is a *peak* level; and (ii) revise Section 25.226(a)(1)(ii)(B) to eliminate any implication that the 0.2 degree pointing tolerance is a *maximum* level.

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[34] *See* 47 C.F.R. §§ 25.222(a)(7) (2005).

[35] As discussed in Section III.D, *infra*, VMES operators should be permitted to *both* specify pointing tolerances that vary from the default values in Section 25.226 *and* exceed the OAED mask—provided that the combined effect has been coordinated with adjacent satellite operators.

### B. It Should Be Made Clear that VMES Applicants Must Specify Both Peak Pointing Tolerance *and* Maximum Mispointing Levels

New Section 25.226(a)(1)(ii)(B) allows a VMES applicant that wishes to be licensed with a pointing tolerance (*i.e.*, "pointing error") level in excess of 0.2 degrees peak to specify a higher level of pointing tolerance and demonstrate that operations at this higher level would remain within applicable OAED limits.[36] For the reasons discussed above, and in order to allow meaningful comparison with the default 0.2 degree peak pointing tolerance level, any higher pointing tolerance value specified under this provision should be described in *peak* terms, rather than as a *maximum* value as currently suggested by the new rules. At the same time, the Commission should be made aware if an applicant proposes to operate with a *maximum* mispointing limit in excess of the default 0.5 degree limit set forth in Section 25.226(a)(1)(iii)(A)—even if the *peak* pointing tolerance remains less than or equal to 0.2 degrees. At bottom, both peak pointing tolerance *and* maximum mispointing values should be specified in order to ensure that each VMES operator *normally* maintains an acceptable pointing tolerance and *never* exceeds a critical upper limit.

To ensure that the Commission has all of the information it needs to evaluate VMES applications and monitor ongoing VMES operations, ViaSat respectfully requests that the Commission: (i) revise Section 25.226(a)(1)(ii)(B) by substituting the word "peak" for the word "maximum;" and (ii) revise Section 25.226(a)(1)(iii)(B) to permit a VMES applicant to specify a *maximum* mispointing limit in excess of 0.5 degrees, provided the proposed operations comply with applicable OAED limits, and also to require the applicant to use that maximum mispointing limit as the relevant mispointing "shut-off" limit.

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[36] 47 C.F.R. § 25.226(a)(1)(ii)(B).

### C. It Should Be Made Clear that "Pointing Error" Includes Both Deliberate *and* Non-Deliberate Forms of Antenna Misorientation

Sections 25.226(a)(1)(ii) and 25.226(a)(1)(iii), like former Sections 25.222(a)(6) and (7), regulate antenna mispointing in order to cabin the threat of harmful interference into adjacent operations. The antenna pointing requirements promulgated by the *VMES Order* are based on those established in the *ESV Reconsideration Order*, in which the Commission recognizes that "[a]ntenna mispointing may result from the rapid movement of the vessel, a time-lag in the antenna tracking mechanism or an insensitivity of the tracking software to the precise direction of the satellite as seen from the vessel."[37] While this list doubtless is intended to be representative and not exhaustive, that the Commission names only *non-deliberate* sources of antenna misorientation creates uncertainty as to whether *deliberate* sources of antenna misorientation are considered to be "pointing error" under the new rules.

Notably, VMES terminals may utilize closed-loop tracking to facilitate accurate pointing toward the target satellite. Closed-loop tracking systems deliberately misorient the antenna around a tracking "loop" in order to determine whether signal strength from the target satellite can be improved. Because signal strength increases with more accurate pointing, if signal strength can be improved by "mispointing" the antenna toward a given point in space, the system will reorient the antenna toward that point.

Misorientation due to closed-loop tracking or other deliberate system processes has the same potential for causing harmful interference into adjacent operations as non-deliberate forms of misorientation, such as those listed in *ESV Reconsideration Order* and referenced above. However, not explicitly addressing deliberate forms of antenna misorientation increases

the risk that VMES applicants and operators will fail to account for and guard against the interference risk that may result from such misorientation. As such, ViaSat respectfully requests that the Commission revise Section 25.226(a)(1)(ii) to clarify that both forms of misorientation can give rise to pointing error under the new rules, and should be accounted for in VMES applications.

An applicant should be permitted to deliberately offset an antenna by more than 0.2 degrees peak in order to facilitate closed-loop tracking (or for other purposes) after: (i) specifying higher pointing tolerance levels to the Commission; and (ii) ensuring the consistency of the proposed operations with applicable OAED limits. Thus, clarifying that pointing tolerance includes both deliberate and non-deliberate antenna offsets would not restrict VMES operations, but would ensure that the Commission, the satellite industry, and the public have more complete information with which to evaluate VMES applications.

### D. It Should Be Made Clear that VMES Operators May Vary from Default Pointing Tolerances *and* the OAED Mask If Those Operations Have Been Coordinated

In the *ESV Reconsideration Order*, the Commission recognized that where ESV operations are successfully coordinated with adjacent satellites at an off-axis power-density level that exceeds the OAED mask, there is "no reason to preclude the earth station from operating at that [off-axis] power-density level with the particular target satellite that has been coordinated."[38] The Commission recognized that allowing operations at variance from the OAED mask would: (i) provide ESV operators with greater operational flexibility while ensuring that adjacent satellite operators are protected from harmful interference; (ii) enable U.S.-licensed ESV

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[37] *See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, IB Docket No. 02-10, FCC 09-63, at ¶ 18 (Jul. 30, 2009) (" *ESV Reconsideration Order*").

operators to compete with foreign competitors in areas of the world where two-degree spacing is not common; and (iii) ensure that ESVs have the operating capacity to provide quality service to their end-users.[39] The *VMES Order* incorporates these standards into the VMES service rules.[40] ViaSat fully supports these policy goals.

While the new rules afford VMES operators much-needed flexibility with which to provide innovative services to the public, they stop one step short of providing the full flexibility intended by the *VMES Order*. Specifically, while Section 25.226(a)(2) of the Commission's rules now permits VMES operators to exceed the OAED mask following coordination with adjacent operators, Sections 25.226(a)(1)(ii)(B) and 25.226(a)(1)(iii)(B) require a VMES network to comply with the mask if a VMES terminal's antenna pointing tolerances do not comply with the default values in the rules (*i.e.*, 0.2 degrees peak, and 0.5 degrees maximum).

In other words, the new rules force operators to choose between: (i) greater flexibility in the application of the OAED mask; and (ii) greater flexibility in the application of the antenna pointing tolerance levels. ViaSat submits that it is unnecessary to force VMES operators to make such a choice. As the Commission found in the *ESV Reconsideration Order*, where proposed operations have been coordinated, such coordination ensures that adjacent operations will not be harmed, and obviates the need for the Commission to independently conduct an interference analysis. Put differently, there should be no need to continue to require rigid adherence to the pointing tolerances in Section 25.226 in order to protect adjacent

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[38] *Id.* at ¶ 12.

[39] *Id.*

[40] *See VMES Order* at ¶ 97 and n. 204.

operations where adjacent satellite operators themselves have found that such protection is unnecessary.

In context, it appears likely that the Commission intended to allow operators to take advantage of both forms of relief simultaneously. That result would be consistent with the intent of the *VMES Order* and *ESV Reconsideration Order*—namely, to maximize operator flexibility provided harmful interference does not result from such flexibility. Further, that result would be consistent with recent Commission action in the AMSS context, in which the Commission "decline[d] to address . . . arguments concerning adjacent satellite interference"—including significant issues with respect to the applicant's ability to comply with a 0.2 degree "pointing error" limit—because the applicant had "resolved these interference issues through coordination with potentially affected satellite operators."[41] All participants in emerging markets for mobile applications of the FSS should be entitled to an equivalent level of flexibility.

Accordingly, ViaSat urges the Commission to revise Sections 25.226(a)(1)(ii)(B) and 25.226(a)(1)(iii)(B) to acknowledge explicitly that if an applicant has coordinated higher OAED levels with adjacent satellite operators, that applicant may specify higher pointing tolerance levels so long as operations comply with those higher OAED levels.

* * * * *

By adjusting the VMES rules as discussed herein, the Commission can provide the flexibility needed for VMES operators to deliver the most cost-effective and spectrally-efficient broadband services possible, using smaller, low-cost terminals that will facilitate widespread adoption *without* adversely affecting the interference environment. Because the

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[41] *See Row 44, Inc., Application to Operate up to 1,000 Technically Identical Aeronautical Mobile Satellite Service Transmit/Receive Earth Stations Aboard Commercial and Private Aircraft*, Order and Authorization, DA 09-1752, at ¶ 22 (Aug 4, 2009).

requested changes will further "increase the potential that broadband communications capabilities will be made available for various emergency preparedness and commercial purposes where high-bandwidth, advanced mobile communications capabilities are beneficial,"[42] while ensuring that the new VMES rules are consistent with both the mandate set forth by Congress in the Recovery Act and the Commission's efforts to develop and implement the National Broadband Plan, ViaSat respectfully requests that the Commission revise its new VMES rules as proposed in Exhibit A hereto.

Respectfully submitted,

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December 4, 2009

[42] *VMES Order* at ¶ 2.

## Exhibit A: Proposed Revisions to New Rules

**Section 25.226(a)(1)(ii):**

Each VMES transmitter must meet one of the following ~~antenna pointing~~ requirements **with respect to antenna pointing error (which shall encompass both deliberate and non-deliberate forms of antenna misorientation)**:

(A) Each VMES transmitter shall maintain a **peak** pointing error of less than or equal to 0.2° between the orbital location of the target satellite and the axis of the main lobe of the VMES antenna, or

(B) Each VMES transmitter shall declare a ~~maximum~~ **peak** antenna pointing error that may be greater than 0.2° provided that the VMES does not exceed the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section **(or any other off-axis EIRP spectral-density limits allowed under paragraph (a)(2) of this section),** taking into account the antenna pointing error.

**Section 25.226(a)(1)(iii):**

Each VMES transmitter must meet one of the following cessation of emission requirements:

(A) ~~For VMESs operating under paragraph (a)(1)(ii)(A) of this section, a~~**A**ll emissions from the VMES **transmitter** shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the VMES antenna exceeds 0.5°, and transmission ~~will~~ **may** not resume until such angle is less than or equal to ~~0.2°~~**the applicable peak antenna pointing error under paragraph (a)(1)(ii) of this section**, or

(B) **Each VMES transmitter shall declare a maximum antenna pointing error that may be greater than 0.5° provided that the VMES does not exceed the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section (or any other off-axis EIRP spectral-density limits allowed under paragraph (a)(2) of this section), taking into account the antenna pointing error.**

~~For VMES transmitters operating under paragraph (a)(1)(ii)(B) of this section, a~~**A**ll emissions from the VMES **transmitter** shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the VMES antenna exceeds ~~the~~ **this** declared maximum antenna pointing error**.** and **transmission may** ~~shall~~ not resume ~~transmissions~~ until such angle is less than or equal to the ~~declared maximum~~ **applicable peak** antenna pointing error **under paragraph (a)(1)(ii) of this section**.

**Section 25.226(a)(3)(i):**

Except as defined under subsection (a)(3)(ii) below, the effective aggregate EIRP density from all terminals shall ~~be at least 1 dB below~~ **comply with** the off-axis EIRP-density limits defined in (a)(1)(i)(A)-(C)**, where N is equal to one**. In this context the term "effective" means that the resultant co-polarized and cross-polarized EIRP-density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single VMES transmitter operating ~~1 dB below~~ **at** the limits defined in (a)(1)(i)(A)-(C)**, where N is equal to one**. A VMES system operating under this subsection shall file certifications and provide a detailed demonstration as described in paragraphs (b)(3)(i) and (b)(3)(iii) of this section.

**Section 25.226(a)(9):**

~~Each VMES terminal shall automatically cease transmitting within 100 milliseconds upon loss of reception of the satellite downlink signal.~~ **VMES operators licensed pursuant to this section are prohibited from using remote earth stations in their networks that are not designed to stop transmissions from their remote earth stations when synchronization with the target satellite fails.**

**Section 25.226(b)(3)(i):**

The applicant shall make a detailed showing of the measures it intends to employ to maintain the effective aggregate EIRP-density from all simultaneously transmitting cofrequency terminals operating with the same satellite transponder ~~at least 1 dB below~~ **in compliance with** the EIRP-density limits defined in paragraphs (a)(1)(i)(A)-(C) of this section**, where N is equal to one**. In this context the term "effective" means that the resultant co-polarized and cross-polarized EIRP density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single VMES transmitter operating ~~at 1 dB below~~ **at** the limits defined in paragraphs (a)(1)(i)(A)-(C) of this section**, where N is equal to one**. The International Bureau will place this showing on Public Notice along with the application.

## Exhibit B: RF Exposure Calculations for Selected VMES Systems

**Table B.1: Antenna Characteristics of Selected VMES Systems**

| Operator | Ant Diameter (m) | Ant Area (m^2) | Ant Gain (dBi) | PA Pwr to Ant (W) | Near Field Dist (m) | Near Field Pwr Density (mW/cm^2) | Start of Far Field Dist (m) | Far Field Pwr Density (mW/cm^2) |
|---|---|---|---|---|---|---|---|---|
| General Dynamics | 0.600 | 0.283 | 37.70 | 15.10 | 1.36 | 15.80 | 10.22 | 6.77 |
| L-3 Titan | 0.500 | 0.130 | 34.40 | 13.00 | 2.50 | 10.52 | 6.00 | 4.51 |
| SES Americom | 0.159 | 0.127 | 34.71 | 2.60 | 9.00 | 1.04 | 23.00 | 0.11 |
| RaySat | 0.245 | 0.047 | 27.50 | 26.31 | 0.71 | 83.49 | 1.70 | 35.77 |

**Table B.2: RF Exposure During Intervals of 1-5 Seconds**

| Operator | Near Field Pwr Density (mW/cm^2) | Allowable Pwr Density ((mW*min)/cm^2)[43] | Exposure for Various Shut-Down Times ((mW*min)/ cm^2) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 s | 2 s | 3 s | 4 s | 5 s |
| General Dynamics | 15.80 | 30 | 0.2633 | 0.5267 | 0.7900 | 1.0533 | 1.3167 |
| L-3 Titan | 10.52 | 30 | 0.1754 | 0.3508 | 0.5262 | 0.7016 | 0.8770 |
| SES Americom | 1.04 | 30 | 0.0173 | 0.0347 | 0.0520 | 0.0693 | 0.0867 |
| RaySat | 83.49 | 30 | 1.3915 | 2.7830 | 4.1746 | 5.5661 | 6.9576 |

[43] Calculated using the OET 65 General Population Limit of 1 mW/cm^2 and an averaging time of 30 minutes.

**Table B.3: Number of Exposures Allowed During a 30-Minute Period**

| Operator | Permissible Instances of Exposure for Various Shut-Down Times | | | | |
|---|---|---|---|---|---|
| | 1 s | 2 s | 3 s | 4 s | 5 s |
| General Dynamics | 114 | 57 | 38 | 28 | 23 |
| L-3 Titan | 171 | 86 | 57 | 43 | 34 |
| SES Americom | 1731 | 865 | 577 | 433 | 346 |
| RaySat | 22 | 11 | 7 | 5 | 4 |

## ENGINEERING INFORMATION CERTIFICATION

I hereby certify that I am the technically qualified person responsible for reviewing the engineering information contained in the foregoing submission, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is complete and accurate to the best of my knowledge and belief.

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